Reviews and Bibliographical Notices.

I.—HERBERT SPENCER: PSYCHOLOGY.

THE PRINCIPLES OF PSYCHOLOGY. BY HERBERT SPENCER. 2 Vols. 1876.

It would be hardly possible to profitably study Mr. Spencer's Psychology, apart from his system as a whole, but more especially from his *Principles of Biology*, which immediately precedes psychology in the order of development of his scheme of the philosophy of evolution.

There is a dominant idea which more or less consistently pervades his system from beginning to end, which should be apprehended at the outset, in a study of any of its parts. In a consideration of his Psychology, it is hardly less important to understand Mr. Spencer's mode of explaining the genesis of vitality or life, which in his hands, in the course of a progressive evolution ripens finally into mind.

And such in brief will be our course in the present attempt, to estimate in some respects the scientific and practical value of his psychological doctrines, for such of our readers as may not have made an independent study for themselves. This is all the more necessary in a JOURNAL like our own, at a time when a new edition of the author's writings is issuing from the press, and when it is remembered that his views have been more or less largely adopted by British and American medical psychologists.

Then, as for ourselves, we have not been able to accept as freely as some others have done, much that belongs to his methods and reasonings, and hence much that is found in his conclusions. And this statement is made, we trust, in full view of the eminent service Mr. Spencer has rendered in various important fields, more particularly in aiding the systematic or generalizing side of science, at a time when such a work was greatly needed.

It would seem to have been a rare occurrence to have met with minds, capable on the one hand of the fruitful observation and study of individual facts, and on the other, possessed of the highest powers of philosophical generalization. A Descartes,

a Bacon, a Bichat, and a very few others ranking below, but worthy to be classed with them, exhausts the list in modern times. It is too early, perhaps, to assign Mr. Spencer's relative place within this class, even if he should be found to have just claims to enter it. But this much can be said, that his chief title to recognition appears to lie in his powers of generalization, and hence as already said in his service to the systematic side of science, or rather, we should say—human knowledge.

For his scheme certainly has the merit of comprehensiveness, since it aims at nothing less than embracing within its confines, the sum total of human knowledge, actual and possible, ranging the materials of the same with a remarkable display of capacity for analysis and synthesis, in subordination to the *law of evolution.* In the endeavor to execute this ambitious and herculean task, he has succeeded beyond ordinary expectation, in impressing his views upon and in quickening the thought of his times. Multitudes of minds of this generation have been excited and guided by his varied, and upon the whole, attractive writings. Perhaps no philosophic writer of the past quarter of a century, has said, or done more, if as much, to stimulate thought, in so many healthy directions, as Mr. Spencer. But after all, speaking for ourselves, after a pretty careful study of his works, we believe we have found rather ample evidence, that he has been unduly fascinated by the splendid generalities of his system, and that he has been thus betrayed at times, if not into loose observations, at least into loose assumptions, and pressed by the exigencies and voids of his scheme, has in the refinement of his speculations, habitually trespassed on the grounds forbidden to legitimate inference. Comprehensively surveyed, his system appears to our eyes to present a universe of suggestive conclusions on a very limited basis of facts.

The dominant idea in the philosophy of Mr. Spencer, is as every one knows, that of *evolution.* After distinguishing the *knowable* from the *unknowable*, in which he follows closely Sir William Hamilton and Dr. Mansell, the chief aim of his work, entitled *First Principles*, is to unfold the law or laws of evolution.

The conception embodied in this case, makes it necessary in a survey of the universe to begin with the most fundamental phenomena. or factors attainable by analytic processes, which are for the physical world, two in number *matter* and *force.* These, neglecting certain refinements, constitute the points of departure of the evolution. This takes place by a series of "differentiations," in either and between both, with subsequent "integrations" and "re-integrations," as between portions of matter or forms of force that have *somehow* come to differ from each other. There results sooner or later, several special kinds of matter and force, with various kinds of motion. But we have never been able to see how these "differentiations," etc., were brought to pass. In every case they have to be assumed.

While these various kinds of matter, force and motion, agree among themselves, according to their class, in important respects, they have *somehow* come to differ in properties in others. By re-acting on each other according to their differences, they give rise to other and more complex forms of matter and force. Each advance that is made in the "evolution," the results are more and more complex continuously, and so on *ad infinitum.* The procedure is from the "general" to the "special," from the "simple" to the "complex," from the "homogeneous" to the "heterogeneous." From the simple beginning as stated,—matter and force, and the capability of motion being given,—the whole system of the visible universe, organic and inorganic, animate and inanimate, is "evolved." The substance in which changes are wrought, is matter; the cause or condition of all change, is force, or as it would appear, motion.

It is the deliberate aim in the scheme of Mr. Spencer, to analyze all phenomena, whatsoever their kind, into one or other of these factors as their sufficient basis. Proceeding on such an assumption, that part of the natural world is first entered wherein we find matter and force or motion, in their simplest forms and manifestations—the *inorganic.* Guided through it by the idea of "evolution from the simple to the complex," the advance is made upwards through physics to chemistry and beyond, when we begin almost insensibly to meet with the more complex and special phenomena of life or vitality. The latter it is admitted are new, but a sharp analysis reveals the fact that they contain nothing new, or at least nothing worthy of mention, besides matter and force or motion. There has been simply a series of "differentiations," "combinations" "and unfoldings." The phenomena are more complex in their "relations of co-existence and sequence," and this is all.

Ascending now through the domain of living beings, under the guidance of the "law of evolution," from the lowest vegetable to the most exalted animal forms, we begin to meet with a new order of phenomena, usually called *mental.* These seem at first to be radically different from what had been met with before, but the difference is only a seeming. The "law of progress" or of "evolution from the simple to the complex," read inversely, proves equal to the emergency and we are led back on converging lines to the simple primal factors, matter, and force or motion. And so on to the end until all phenomena, physical, vital, intellectual and moral, have been subordinated to the sway of this comprehensive law.

Not only have the *objects* of knowledge fallen into a progressive order in obedience to this law, but it has also determined the relations, and hence the order of our knowledge. The classifications of the same, hitherto made, in which, except in view of subordinate distinctions, the sciences have been ranged in at least two parallel classes, "physical" and "mental", is consistently abolished in the scheme of Mr. Spencer. Be-

ginning according to the terms of the law above mentioned with the simplest or most fundamental of the sciences, the advance is made not on two co-ordinate lines simultaneously, but on one line, from physics to chemistry, from chemistry to physiology or biology, and from biology to psychology, and from psychology or a study of the individual to sociology, or the study of men in a state of aggregation—or in view of their relations to each other,—finding somewhere within the confines of *sociology* a place for higher morals and religion.

Let the mind of the student once become permeated and swayed by a knowledge and the spirit of the law of evolution, and with no more than ordinary imaginative power, he can rise above the scheme and course of nature, which can be thus brought under the eye of the mind in its entirety, and he may glance in his mental vision, from the "star dust" of the most primeval times, along the unbroken and ever-widening track of evolution to its last and highest term, in the process of unfolding; viz., *man*.

One of the notable features in this grand process is the implied profession, that nothing is imported or admitted from without, from the time of its beginning to the end. No new elements are required or slipped in by the way. The entire stock of materials and forces were taken up at the start, and they are as we have seen, simply matter and force, physical force, or motion. These furnish the warp and woof of the process and its total results or products. The mechanism of evolution is self-contained and self-acting. It does not need and does not have any outward aid or impulse, whether human or divine.

In the first part of Mr. Spencer's work, entitled *First Principles*, is laid the philosophical basis of his system. Under the head of the "unknowable," he dismisses the gods, not only from the sphere of human knowledge, but like Epicurus of old, from the care of the universe.

Such is a mere outline of the system of Mr. Spencer, in its widest generalities.

From this brief characterization, we pass to the special subject in hand, that is, an examination in certain of its aspects of our author's work, entitled *Principles of Psychology.* Speaking of the facts of psychology, Mr. Spencer says, "before beginning their study from a psychological point of view, we have first to study them from a *physiological* point of view." (p. 14). It is to this latter and possibly more practical phase of the subject, to which we would direct chiefly the attention of our readers. In our own minds, we have a direct experience or a consciousness of volition, thought, feeling, etc. This is the field of psychology in its more restricted sense. But in a study of mind from a stand-point as purely physiological as possible, we study the *signs* of mental action and feeling from the outside, and hence must deal with the organisms of animals, more particularly their nervous systems and the parts like the muscu-

lar system, most immediately subservient to it. This makes it necessary to consider the structure and modes of action of the nervous system, even in disease. And this is the point of view of most practical importance to the physician if not to the professed philosopher.

This course will lead us naturally to examine first in order Mr. Spencer's statements, respecting the mechanism and modes of action of the nervous system. The general account of the structure and modes of action of the nervous system with which the first volume may be said to open, though concise, is graphic and may be accepted as correct, as far as it goes.

The nervous functions; as a whole, being reduced in the last analysis to some form of motion, are divided by Mr. Spencer into the *recipio-motor*, or sensory, the *libero-motor*, or motor functions proper of the gray matter, and finally the *dirigo-motor* or the motor nerves which pass out to the organs to be set in action.

The cerebellum is held hypothetically to be "an organ of doubly-compound co-ordination in *space*, while the cerebrum is an organ of doubly-compound co-ordination in *time*." (P. 61, Vol. I.). In a note on the next page, Mr. Spencer adds :

> "It should be remarked that the above-proposed definitions, are, to a considerable extent, coincident with current conceptions. The *cerebrum* is generally recognized as the chief organ of mind; and mind, in its ordinary acceptation, means more especially a comparatively intricate co-ordination in *time* — the consciousness of a creature "looking before and after," and using past experiences to regulate future conduct. In like manner the function ascribed to the *cerebellum* in the foregoing paragraph, partially agrees with that which M. Flourens inferred from his experiments. It differs, however, in two respects. It implies that the *cerebellum* is not an organ for the co-ordinations of motions only, or of synchronous motions only; but that it is also an organ for the co-ordination of simultaneous impressions, and for the co-ordination of the synchronous motions in adaptation to the simultaneous impressions. And it further implies that not all simultaneous impressions and adapted synchronous motions are co ordinated by the *cerebellum;* but only the doubly-compound ones, which have for their external correlatives the intricate combinations of attributes that distinguish objects from one another, and the more multiplied and varied localizations of objects in the space that extends beyond the immediate limits and reach of the organism." (P. 62).

But we will refrain from remark on the adequacy of these generalizations of the functions of the cerebellum and cerebrum, until a later part of this notice, where they may receive attention.

"The conditions essential to nervous actions," are next considered. They are declared to be "continuity of nerve substance," the maintenance of a regular temperature at a certain level, differing, however, in certain animals; a regular supply of healthy blood, healthy in quantity and quality, and finally the absence of certain matters, the presence of which would disturb or destroy nervous action.

As regards the mode of action of the nervous system, the following passage, perhaps, in as concise a form as any other, expresses Mr. Spencer's views :

"Briefly reviewed from a somewhat different stand-point, the following are the leading facts which it concerns us to remember:

"Nervous stimulations and discharges consist of waves of molecular change, that chase one another rapidly through nerve-fibres. The stimulus or discharge formed of such waves, arises at some place where unstable nerve-substance has been disturbed; *and is the same* no matter what agent caused the disturbance. The successive waves severally travel with a velocity which, though considerable, compared with ordinary sensible motions, is extremely slow, compared with other kinds of transmitted molecular motions. And each set of waves, while itself caused by the decomposition of unstable nerve-matter, is a means of decomposing other unstable nerve-matter; so generating further and often stronger sets of waves, which similarly chase one another into many and distant parts of the nervous system.

"There is a triple rhythm in these nervous stimulations and discharges—each form of rhythm being due to the greater or less incapacity for action which an action produces. We have seen that every wave of isomeric transformation passing along a nerve-fibre, entails on it a momentary unfitness to convey another wave; and that it recovers its fitness only when its lost molecular motion has been replaced and its unstable state thus restored. We have also seen that any portion of grey matter in a nerve-center, which having been disturbed and partially decomposed has emitted a shock of molecular change, is proportionately incapacitated; and that it recovers its original ability only as fast as it re-integrates itself from the materials brought by the blood. And then there comes the further rhythm constituted by the alternations of sleep and waking—a rhythm having the same origin as the last, and being supplementary to it.

"The remaining truth which we have contemplated is that each special stimulation and the special discharge produced by it, do not together form the whole of every nervous act; but that there is always an accompanying general stimulation and general discharge. Every part of the nervous system is every instant traversed by waves of molecular change—here strong and here feeble. There is a universal reverberation of secondary waves induced by the stronger primary waves, now arising in this place and now in that; and each nervous act thus helps to excite the general vital processes while it achieves some particular vital process. The recognition of this fact discloses a much closer kinship between the functions of the nervous system and the organic functions at large, than appears on the surface. Though unlike the pulses of the blood in many respects, these pulses of molecular motion are like them in being perpetually generated and diffused throughout the body; and they are also like them in this, that the centripetal waves are comparatively feeble, while the centrifugal waves are comparatively strong. To which analogies must be added the no less striking one, that the performance of its office by every part of the body, down even to the smallest, just as much depends on the local gushes of nervous energy, as it depends on the local gushes of blood." (P. 95, Vol. I.).

In this account as a mere hypothetical statement of a subject, which is open only to the incursions of inference, we see nothing to which to object. One merit it has, depends on attributing the passage of nervous impressions to vibrations, rather than to the *circulation of a nervous force or fluid.* This latter is a clumsy hypothesis in favor of which, not a single fact exists, and none but superficial analogies.

But we will now invite the attention of our readers to Mr. Spencer's account of the mode of formation of the nervous system. It occurs under the head of "*the genesis of nerves.*" Not less than twenty pages in the aggregate are given to this subject, in the *Biology* and *Psychology.*

The following passage is cited partly as an example of Mr. Spencer's mode of treating such subjects, and of the extent and the microscopic minuteness of detail, to which he carries his physical speculations, even into the provinces of biology and psychology. Let the reader not be wearied with the tedious account which follows. It embraces only certain selections from the chapters devoted to the subject in hand. How then is the nervous system formed, according to Mr. Spencer, and what is the scientific and practical value of his speculations?

"*Supposing* the various forces throughout an organism to be previously in equilibrium, then any part which becomes the seat of a further force, added or liberated, must be one from which the force, being resisted by smaller forces around, will initiate motion towards some other part of the iorganism. *If* elsewhere in the organism there is a point at which force bs being expended, and which so is becoming minus a force which it efore had, instead of plus a force which it before had not, and thus is made a point at which the re-action against surrounding forces is diminished; then, manifestly, a motion taking place between the first and the last of these points is a motion along the line of least resistance. Now a sensation implies a force added to, or evolved in, that part of the organism which is its seat; while a mechanical movement implies an expenditure or loss of force in that part of the organism which is its seat. * * * When there is anything in the circumstances of an animal's life, involving that a sensation in one particular place is habitually followed by a contraction in another particular place — when there is thus frequently-repeated motion through the organism between these places; what must be the result as respects the line along which the motions take place? Restoration of equilibrium between the points at which the forces have been increased and decreased, must take place through some channel. If this channel is affected by the discharge — if the obstructive action of the tissues traversed, involves any reaction upon them, deducting from their obstructive power; then a subsequent motion between these two points will meet with less resistance along this channel than the previous motion met with; and will consequently take this channel still more decidedly."

"To aid our conceptions, we will, as before (§ 19), take the rude analogy furnished by a row of bricks on end, which overthrow one another in succession. If such bricks on end have been adjusted so that their faces are all at right angles to the line of the series, the change will be propagated along them with the least hindrance; or, under certain conditions, with the greatest multiplication of the original impulse. For when so placed, the impact each brick gives to the next, being exactly in the line of the series, will be wholly effective; but when they are otherwise placed it will not. If the bricks stand with their faces variously askew, each in falling will have a motion more or less diverging from the line of the series; and hence only a part of its momentum will impel the next in the required direction. Now, though in the case of a series of molecules, the action can be by no means so simple, yet the same principle holds. The isomeric change of a molecule must diffuse a wave which is greater in some one direction than in all others. If so, there are certain relative positions of molecules, such that each will receive the greatest amount of this wave from its predecessor, and will so receive it as most readily to

produce a like change in itself. A series of molecules thus placed must stand in symmetrical relations to one another — polar relations. And it is not difficult to see that, as in the case of the bricks, any deviation from symmetrical or polar relations will involve a proportionate deduction from the efficiency of the shock, and a diminution in the quantity of molecular motion given out at the far end. (But now, what is the indirect result when a wave of change passes along a line of molecules thus unsymmetrically placed? The indirect result is that the motion which is not passed on by the unsymmetrically-placed molecules, goes towards placing them symmetrically.) Let us again consider what happens with our row of bricks. When one of these in falling comes against the next, standing askew, its impact is given to the nearest angle of this next, and so tends to give this next a motion round its axis. Further, when the next thus moved delivers its motion to its successors, it does this not through the angle on the side that was struck, but through the diagonally opposite angle; and, consequently, the reaction of its impact on its successor adds to the rotatory motion already received. Hence the amount of force which it does not pass on, is the amount of force absorbed in turning it towards parallelism with its neighbors. Similarly with the molecules. Each in falling into its new isomeric attitude, and passing on the shock to its successor, gives to its successor a motion which is all passed on, if the successor stands in polar relation towards it, but which, if the relation is not polar, is only partially passed on — some of it being taken up in moving the successor towards a polar relation. One more consequence is to be observed. Every approach of the molecules towards symmetrical arrangement, increases the amount of molecular motion transferred from one end of the series to the other. Suppose that the row of bricks, which were at first very much out of parallelism, have fallen, and that part of the motion given by each to the next has gone towards bringing their faces nearer to parallelism; and suppose that, without further changing the positions of their bases, the bricks are *severally restored* to their vertical attitudes; then it will happen that if the serial overthrow of them is repeated, the actions, though the same as before in their kinds, will not be the same as before in their degrees. Each brick, falling as it now does more in the line of the series, will deliver more of its momentum to the next; and less momentum will be taken up in moving the next towards parallelism with its neighbors. If then, the analogy holds, it must happen that in the series of isomerically-changing molecules, each transmitted wave of molecular motion is expended partly in so altering the molecular attitudes as to render the series more permeable to future waves, and partly in setting up changes at the end of the series; that in proportion as less of it is absorbed in working this structural change, more of it is delivered at the far end and greatar effect produced there; and that the final state is one in which the initial wave of molecular motion is transmitted without deduction — or rather, with the addition of the molecular motion given out by the successive molecules of the series in their isomeric falls.

"From beginning to end, therefore, the development of nerve results from the passage of motion along the line of least resistance, and the reduction of it to a line of less and less resistance continually. The first opening of a route along which equilibrium is restored between a place where molecular motion is in excess and a place where it is in defect, comes within this formula. The production of a more continuous line of that peculiar colloid best fitted to transmit the molecular motion, also comes within this formula; as does likewise the making of this line thicker and more even. And the formula also covers that final process by which the line, having been formed, has its molecules brought into the polar order which least resists, and indeed facilitates, the transmission of the wave.

"Otherwise, we may say that while each passage of a wave is the establishment of an equilibrium between two places in the organism, the

formation of this line of easy transmission is an approach towards equilibrium between the structural arrangements of the line and the forces to which it is exposed. While its molecules are so arranged as to offer resistance to the passing wave, they are liable to be changed in position by the wave — they are out of equilibrium with the forces they are subject to. Each approach towards an attitude of equilibrium is a change towards diminished resistance. And so on until there are simultaneously reached the state of structural equilibrium and no resistance.

"Carrying with us these conceptions, we now pass from the genesis of nerves to the genesis of nervous systems. We will look at these in their successive stages of evolution." (P, 511-520, Vol. I.)

Now, let the reader give attention to this lengthy extract, in which Mr. Spencer labors, through a mass of pure conjectures, fine spun physical hypotheses, and bare assumptions, to show how nerves are developed or "evolved."

What real necessity was there for entering such a field, which could only be traversed in such a manner? Is there the slightest real proof that the process of the "genesis of nerves," so elaborately worked out by Mr. Spencer, is the true one? Not the least, so far as we know, and we have had some opportunity to make the acquaintance of such matters. Mr. Spencer begins by "supposing" an *organism*, the various forces in which are assumed for the sake of a case to be "in equilibrium."

He next *supposes* this hypothetical organism to "become the seat of a further force, added or liberated."

He then supposes this "further force" to "initiate motion towards some other part of the organism," because, as it is *assumed*, it is "resisted by smaller forces around." It is next conveniently "supposed," that "elsewhere in the organism there is a point at which *force is being expended*, and which so is becoming minus a force which it had before, instead of plus a force which before it had not, and thus is made a point at which the reaction against surrounding forces is diminished."

All these gratuitous suppositions and pure assumptions being granted, the conclusion inevitably follows, that "a motion taking place between the first and the last of these points, is a motion along the line of least resistance."

Before we pass on, we must ask the reader to look once again at the *premises* from which this conclusion has been deduced, for we will soon see what use is made of it and we must remember its value. Says Mr. Spencer, "a sensation implies a force added to or evolved in that part of the organism which is its seat," while on the contrary "a mechanical movement implies an expenditure or loss of force in that part which is its seat."

Here we have an organism *assumed*, capable of feeling and of motion. The problem is to establish a nervous track, or in other words a nerve-fibre to connect these two seats of action. How is this track or fibre developed?

It is in the attempt to show how this is done, that Mr. Spencer uses his "rude analogy of a row of bricks."

At first "their faces are all at right angles to the line of the

series." Then they are all knocked down. Next they are set up again " with their faces variously askew." Then they are thrown down again. At this point, Mr. Spencer passes over to a line of imaginary molecules in the organism, connecting the assumed seats of sensation and of motion in the supposed organism. Though it is admitted that " the case of the series of molecules can be by no means so simple," yet it is assumed the *the* "*same principle* holds " in the one case as in the other. A shock is " supposed " to pass along this " supposed " line of molecules.

If the molecules are placed by assumption unsymmetrically or "askew," " it is not difficult," says Mr. Spencer, " to see, that, *as in the case of the bricks*, any deviation from symmetrical relations will involve a proportionate deduction from the efficiency of the shock and a diminution in the quantity of molecular motion given out at the far end," or in other words, at the seat of motion,— muscular motion.

Having granted an imaginary organism in the proper state, and seats of sensation and motion, and conjectural shocks, passing in an assumed line of direction between them, and having granted molecules "askew," or unsymmetrically placed, having, we say, granted all these things in an entire absence of proof of their having ever existed, in fact, the following question is asked: " But now, what is the indirect result when a wave of change passes along a line of molecules thus unsymmetrically placed? The indirect result is that the motion which is not passed on by the unsymmetrically placed molecules, goes towards placing them symmetrically. To illustrate the case in its present phase, recurrence is had once again to the " row of bricks," to show how, though the members of the row may stand askew in relation to each other, yet by repeatedly falling against each other, they tend to bring each member squarely into the series. Says Mr. Spencer,—"*similarly* with the molecules." But what a host of assumptions lie back of this point in our progress? " But one more consequence is to be observed." It is, that " every approach of the molecules towards symmetrical arrangement increases the amount of molecular motion transferred from one end of the series to the other."

After once again reverting to the "rude analogy" of the row of bricks, Mr. Spencer says, " *if, then, the analogy holds*, it must happen that in a series of isomerically-changing molecules, each transmitted wave of molecular motion is expended partly, in so altering the molecular attitudes as to render the series more permeable to future waves, and partly in setting up changes at the end of the series; that in proportion as less of it is absorbed in working this structural change, more of it is delivered at the far end and greater effect produced there; and that the final state is one in which the initial wave of molecular motion is transmitted without deduction,—or rather, with the addition of the molecular motion given out by the successive molecules of the series in their isomeric falls."

Now, once again let the reader pause, and assure himself as to what has been really shown in this labored, conjectural account of the process by which the "genesis of nerves" is accomplished, and see whether he is mentally prepared for the next step taken by Mr. Spencer. Surely this cannot be even an exhaustive imaginative account of the genesis of a nerve. What real light has been thrown on the process, or what fact or facts placed in clearer relations by these imaginings of Mr. Spencer? But what is the next step taken in the course of his exposition? It is as follows: "From beginning to end, *therefore, the development of nerve results from the passage of motion along the line of least resistance, and the reduction of it to a line of less and less resistance continually.*" And *this* is the way nerves are formed! But again. "The first opening of a route along which equilibrium is restored, between a place where molecular motion is in excess and a place where it is in defect, comes within this *formula.* The production of a more continuous line of that peculiar colloid, best fitted to transmit the molecular motion, also comes within *this formula*, as does likewise the making of this line thicker and more even. And the *formula* also covers that final process by which the line having been formed, has its molecules brought into the polar order which least resists, and indeed facilitates the transmission of the wave." "And so on until there are simultaneously reached the state of structural equilibrium and no resistance."

Finally, says Mr. Spencer, "carrying with us these conceptions, we *now* pass from the genesis of nerves to the *genesis of nervous systems!*"

This passage is referred to, partly because it shows what are Mr. Spencer's views as to the mode of development of the nervous system, and partly because it is a fair sample of his *mode of working out* his scheme of evolution. It exhibits also to what extent the speculative and generalizing tendency prevails in his work. The passage we have cited is not an uncommon one. It would be easy to cite dozens from his writings just as striking. It will be needless to tell us that it was never intended as more than a mere speculation, by its author, and should be treated as such, and that after all, speculation is not only justifiable but necessary in the advance of science. It is true that speculation within healthy limits is the life of scientific progress, as out of its place it is one of its greatest banes. One of our chief complaints against the work of Mr. Spencer, is that he has to an unsafe and dangerous degree, substituted fact by conjecture, solid premises by pure assumptions, and has used, perhaps, unconsciously, his splendid capacities and great influence in imparting an appearance of solidity to the structure, to the rearing of which his life has been chiefly devoted, and which *may* prove in the future to have anticipated the truth of discovery, but which reposes at present in large measure on unsubstantial conjectures and fine-spun hypotheses. The tone and even the terms of the

closing sentences of the passage given, if they were read before those which precede them, would leave on the mind of the reader, the impression that Mr. Spencer had actually shown how nerves are generated. But what are the facts of the case? An organism is *assumed* with a virtual nervous system to begin with. For does it not have " tissues " and a place and capacity for sensation, and a place and a capacity for motion — presumably muscular motion—and intervening between these parts or places, a " line of that peculiar colloid," capable of transmitting motion from the one place to the other, along a line of molecules fitted to transmit it? What is this, substantially, but a nervous system? And yet what is done by Mr. Spencer but *assume* all these things? All the functions of a simple, nervous system being assumed in the outset, it would seem to be a task unworthy of the name of either science or philosophy, afterwards to gravely construct a mechanism through which these functions are to be accomplished. And we make these strictures in view of the fact that many of the lowest animal organisms do not have either demonstrable nervous or muscular tissues, and yet are capable of some kind of feeling and of motion. If the evolution hypothesis is true, it must be admitted that the time should come in the course of a progressive development, when the apparently structureless lower animals would begin to show some signs of nerve tissue. And it was doubtless the aim of Mr. Spencer to hypothetically describe this process of development. But it is not to the attempt to explain it to which we object in this particular case, it is to the assumption in the outset of an organism performing all the functions of a nervous system, but which is denied a corresponding mechanism. We object to the explanation as wholly inadequate and even superficial, and also to the degree of confidence placed in its sufficiency by its author, as unjustifiable by the premises or course of reasoning on which it is based. It is a harm to the sober and healthy progress of science to employ under the sanction of so high authority, so freely, mere conjecture or speculation, the truth of the results of which it is plainly impossible ever to reach, or lies in the uncertain future. Such prolific use of hypothesis, no doubt is suggestive, and *may* lead the way to important truth, but is far more likely to lead even the best minds into the mazes of error.

All through the subsequent chapters of the work, Mr. Spencer refers the reader to his exposition of the "genesis of nerves," in terms which show he regards it as having a higher value than that of a mere hypothesis.

We ought not to omit to mention, that at the close of the next chapter, Mr. Spencer endeavors to meet in part the objections we have urged, but as we think not successfully.

In the next two or three chapters, Mr. Spencer devotes his work to simple-compound and doubly-compound nervous systems, and in which he conforms so far as facts are concerned, to

known anatomical and physiological data. The portions of these chapters which are novel or peculiar to Mr. Spencer, are almost wholly speculative, and in great measure, so far as we can see, devoid of scientific or practical value. As a mere connected exposition, its warp and woof is too exclusively conjectural. But any further remarks on these subjects, and on our author's treatment of the themes of Psychology proper, must be deferred until our next issue.

[TO BE CONTINUED.]

II.—THE FUNCTIONS OF THE BRAIN.

THE FUNCTIONS OF THE BRAIN. By David Ferrier, M. D. With Numerous Illustrations. p. 323. New-York: G. P. Putnam's Sons, 1876. Chicago: W. B. Keen, Cooke & Co.

For good reasons, the central nervous system, more especially its intra-cranial portion, is attracting at present, a larger share of attention from anatomists, physiologists and pathologists than any other part of the organism. A greater amount of unexplored territory lies within the confines of the spinal cord and brain, under whatever aspect they are considered, than is to be found, it is probable, in any other part of the body. It is, hence, at this time, one of the most tempting domains open to investigation, and the one most likely to yield rewards both scientific and practical, in the immediate future. And this little work of Dr. Ferrier's is one of the best fruits of its study. It is, in a sense, an epoch-making book. It is not only valuable on account of the novel facts it contains, but because of its *suggestiveness*. It is, in large part, made up of physiological facts discovered by the author himself, with sensible and often acute reasonings on them.

We propose to make this notice the occasion for a rather extended review of the present condition of the physiology and pathology of the central nervous system, more particularly of the brain; and hence, while attention is given chiefly to the present work, we shall not hesitate to refer to researches not mentioned in its pages. Most of the facts given in the work, as well as in other recent publications, we have had occasion to notice and discuss in the pages of the JOURNAL, but this will not prevent us from giving a connected statement of those believed to be the most valuable, nor from attempting to estimate their scientific and practical bearings. In the endeavor to carry out this design, it will not be practicable for us to enter on a